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Joint Crediting Mechanism (JCM) and Article 6 of the Paris Agreement

Strengthening Japan-India Technology Collaboration

The Energy and Resources Institute

IGES Institute for Global Environmental Strategies

Joint Crediting Mechanism and Article 6 of the Paris Agreement:

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Issue Brief

Jointly prepared by the *Institute for Global Environmental Strategies (IGES)* and *The Energy and Resources Institute (TERI)*

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Abstract

The long-standing relationship between Japan and India forms a favourable precursor for the countries to collaborate further under the Article 6 mechanisms of the Paris Agreement. While Japan's support to India for promoting low-carbon technology and clean energy use can help minimise carbon emissions, the partnership will in turn give greater market access for Japanese technology in the latter's domestic market. This paper discusses the potential of a Japan-India collaboration under the purview of Article 6 of the Paris Agreement and examines the opportunities for shaping mutual ties through the Joint Crediting Mechanism (JCM). As a bilateral mechanism that facilitates the diffusion of low-carbon technology, the JCM can be a potential pathway to help India meet its growing need for clean technology.

Introduction

Although India is on track to meet its Nationally Determined Contribution (NDC) under the Paris Agreement, absolute emission is expected to continue rising, and the development trajectory of the country could see GHG emissions double by 2050 (TERI & Shell, 2021). India's potential transition to a net-zero economy will heavily depend on the usage of advanced technologies in the key emitting sectors. This transformation will need capacity building, multi-stakeholder cooperation, technology development, mobilization and diffusion of domestic finance along with new and additional funds from developed countries (Shrivastava & Shanmuganathan, 2020). Recognising the growing demand and financial opportunities in transitioning to low-carbon systems, companies, organisations and entrepreneurs have been working towards developing and implementing processes that have lower environmental impacts (TERI & Shell, 2021; Shrivastava & Shanmuganathan, 2020). This study examines the potential for Japan-India technical cooperation in the energy, industrial, and transportation sectors, and highlights the overall technology needs that are relevant in the context of climate change mitigation and renewable energy development. The remainder of this paper is structured starting with highlights on specific technology needs in the key energy-consuming and emitting sectors in India. The following section goes on to highlight the possible mechanisms of internationally recognized technology collaboration options and the potential for collaboration between India and Japan under the Joint Crediting Mechanism.

India's technology needs in major sectors

Advanced clean technology is pivotal in meeting climate mitigation targets. With the majority of energy needs met by fossil fuels, and with the GHG emissions increasing over the past many decades, India needs integration of advanced technology in all key energy-consuming as well as GHG emitting sectors. This section elaborates on the overall technology needs in the country.

Power

The transformation of the energy sector is the focal point of India's NDC and net-zero pathway, as this sector accounts for over three-quarters of the country's total emissions (Shrivastava & Shanmuganathan, 2020; MoEFCC, 2021). India's pathway towards achieving its goals will require rapid adoption of new energy technologies, policy interventions to support energy efficiency and strengthening of low-carbon choices (TERI & Shell, 2021). India has been rapidly working towards shifting to clean energy systems and zero-carbon generation technologies through the widespread adoption of solar and wind power. The electrification of energy services is a major component in transforming energy systems and reducing emissions. This transformation is underway across sectors with most making use of available or near-term technologies (Shrivastava & Shanmuganathan, 2020). However, achieving India's NDC targets will require large-scale and systemic interventions across sectors.

In terms of renewable energy enhancement, solar should be the focal point with an emphasis on transitioning and strengthening the existing grid. The energy loss at the decentralised level is still high and needs to be reduced substantially. Addressing this means that the utility scale and the efficiency of decentralized solar energy need to be improved. Targeted areas could also include building more energy-efficient residential and commercial spaces that are powered only by clean electricity, public infrastructure like street lighting, improving the energy efficiency of household appliances and adoption of more efficient agricultural equipment like tractors, pumps and tillers.

India's rapidly growing energy transition not only needs to be met through the generation of clean energy but also needs to be supported by ensuring energy security. The development of efficient battery storage for addressing power needs will be critical in transitioning to a net-zero economy as well as the need for making it an economically viable option. This, in turn, will lead to greater energy security which the country will need to depend on when transitioning to clean energy. For the hard-to-abate sectors, decarbonisation will be difficult due to its heavy reliance on technological solutions that have not yet been developed or are in the R&D stages. Aviation and heavy transportation sectors will require solutions ranging from synthesized hydrocarbon fuels to biomass energy and hydrogen. Although the technologies for facilitating a transition to a green hydrogen economy already exist, scaled deployment and a viable operating network are yet to be functionally established. India's proposed Hydrogen Energy Mission will potentially accelerate the use of advanced technology and strategies for developing necessary supply networks (MoP, 2022). Energy requirements by heavy industrial sectors like iron, steel and cement will need to rapidly transition to using alternative clean fuels such as hydrogen by 2050 in order to minimize their carbon footprint (TERI & Shell, 2021).

Transport

India's Third Biennial Report (2021) highlights that 11% of the net emissions from the whole economy, i.e. roughly 274 million tonnes of annual CO_2 emissions can be attributed to the transport sector. In contrast, India's transport sector presently accounts for only 1.2% of the total electricity consumption. In a projected high electrification scenario, the transport sector's demand for electricity is expected to increase threefold (TERI, 2021). Decarbonisation of the sector will not only have to transform existing infrastructure but also needs to accommodate the rapid rise in demand in the near term.

India's electric vehicles (EV) movement is underway and momentum is growing with various incentives for the public to make the switch to EVs (TERI., 2020). However, there is still room for improvement in terms of technology and vehicle efficiency. The development and deployment of more efficient and longer-lasting batteries will be critical in building India's EV infrastructure. Widespread charging infrastructure also needs to be built up in parallel to the adoption of EVs to support the transition which will depend on technological enhancements, adoption and policy changes (Thakare, et al., 2021). Supporting bus fleets and public transport infrastructure in making the switch to cleaner fuel sources will require them to run on bio-compressed natural gas. As a carbon-neutral fuel, bio-compressed natural gas will be critical, especially for long-distance bus routes. Heavy-duty long-distance fall under the hard-to-abate segment of the sector and presently account for the largest share of transport energy demand. Sustainable mass transit systems must come under focus and be developed with the support of technological cooperation and policy interventions. Aside from metro and bus infrastructure, a shift to rail for mass transit must be emphasized, especially for freight movement through better marketing policies and competitive pricing.

Heavy commercial vehicles currently face the constraint of payload capacity in which case hydrogen-powered fuel cells would provide a solution. Hydrogen as a final energy carrier needs to be adopted more widely for heavy vehicle transportation, thereby overtaking the use of natural gas. Further innovation is still required in low-carbon technologies for heavy-duty long-distance segments (TERI, 2021). Manufacturing of efficient batteries at the industrial scale will be needed to support both transportation and industry, which demands largescale industrial-level production of efficient batteries. Nevertheless, scalability may be time-consuming, unless vital policy changes to support the same are rolled out. Further, innovations in EVs will also be needed for the automobile and appliance sectors to make progress on efficient batteries and motors.

Heavy Industry

Mitigating the impact of emissions from India's heavy industries has so far been slow and predominantly voluntary. The sectors will need to rapidly move to low-carbon technologies that will allow for deeper decarbonisation in order to have a significant transformative impact. The challenge lies in the fact that the technologies required for significant impact are either unproven, have not been deployed, or have not been produced at a commercial scale. These technologies are usually higher priced and unavailable for wider usage. To address these challenges, green finance will be vital in the industry's transition to low-carbon emitters. These sectors need widespread technological innovation and a change in the product mix in order to enable the necessary emissions reduction and transition to a low-carbon pathway for sustainable growth (TERI, 2020).

For hard-to-abate industries and the unavoidable emissions caused by their intensive processes and dependence on coal, a viable option would be of deploying carbon capture, utilization and storage (CCUS) technology directly in steel or cement plants to capture both combustion and process emissions. CCUS technology is still in the R&D and piloting phase in India, with only leading companies having the financial backbone to deploy a few small-scale pilot projects currently underway (Gupta & Paul, 2020). The momentum for CCUS has been growing in India and globally, especially with pledges for carbon neutrality. India is projected to deploy CCUS at a significant scale from 2030 onwards (IEA, 2020). Decarbonising the industry sector will be challenging especially when various processes have limited alternatives. In this context, the use of this technology will be a crucial mitigation alternative to aid the industrial transition. Despite being far from mainstream, the Indian government and industry are actively trying to better understand the economic feasibility and scalability of these low-carbon technologies (Malyan & Chaturvedi, 2021).

Given India's population and economic growth, the country could also look to focus on the cooling sector, which is another critical industry segment for mitigating emissions both in the industry as well as domestic sectors. Technologies such as smart meters, centralised cooling, solar-driven air conditioners (ACs), quick chilling, battery capacity and heat pumps are just some of the areas required for more efficient cooling and refrigeration. Refrigeration of the supply chain would also result in greater food security for perishable items so that they can be stored for longer periods and also travel further distances.

Micro, Small and Medium Enterprises (MSME)

The Indian MSME sector which consumes around 50% of the country's total energy demand (MoSPI, 2021), is yet to see a clear path towards emissions reduction across all industrial sub-sectors. Energy audit studies on the sector project a potential 15-30% energy savings by introducing new energy-efficient technologies and best operating practices (IGES, 2019). Decarbonizing India's MSME industries encounter three challenges: emission reduction in high-temperature heat processes, use of fossil fuel-based chemical feedstock and the presence of process emissions (Swain, 2020). Another significant challenge for decarbonizing India's MSMEs lies in the fact that it is a largely informal economy based. Existing literature suggests that around 20-30 % of the sector's energy requirement and greenhouse gas emissions can be reduced through the adoption of energy-efficient technologies and mobilization of finance towards decarbonisation.

The major emitting MSME sub-sectors that require faster adoption of efficient technologies are food processing, textile, paper and pulp, chemicals, glass and ceramics, brick kilns, rubber, leather, etc. (GIZ, 2018). The sector offers significant emission reduction potential but most of the technologies are not yet commercially viable. Thermal energy dependency as the primary source of fuel for MSMEs implies that fuel consumption and greenhouse gas (GHG) emission patterns are directly proportional. It then becomes a priority to narrow down the MSME sub-sectors with the highest fuel consumption levels to understand the scope of energy savings and GHG emission reduction. In India, there is currently no existing national-level reporting platform for energy consumption from which one can rank the energy-intensive subsectors. However, the fuel consumption data from the Annual Survey of Industries (ASI) can be used for this purpose (IGES-TERI, 2014).

Lack of awareness about the need for transitioning to low-carbon technologies and the capacity to transition are additional challenges faced across the sector. Current research concerning the MSME sector in India revolves around the identification of key challenges for end-users to switch from conventional solid and liquid fuels to natural gas and identify opportunities to apply best practices in policy, technology, financing, etc. to increase the share of natural gas in the energy mix to improve both atmospheric and indoor air quality. Furthermore, work related to the development of a roadmap to make intervention MSME sector energy and resource-efficient have also been carried on by researchers. As a part of mobilizing finances across the MSME sector, research in India also revolves around Investment Grade Energy Audits to sensitize and appraise the unit on the potential of emission reduction and the possible impact on the unit's profitability and competitiveness from its adoption. Preparation of bankable daily project reports is aimed at helping the units in accessing debt finance from financial institutions for the implementation of energy conservation (EC) and technological up-gradation (TU) measures on opting for an ESCO-based implementation model (Pal & Hall, 2019).

Opportunities for technology collaboration between Japan and India

The long-standing relationship between Japan and India forms a favourable precursor for the countries to collaborate further under Article 6 mechanisms. India has much to gain from such a partnership in terms of meeting its NDC and achieving its emission reduction targets with the help of technological assistance, capacity building and financial support. However, in order to have a flexible and fair collaboration, there needs to be set frameworks and regulations which should be designed with consensus from both countries. Policies on setting up and encouraging collaborative partnerships would be required for the markets to adopt and gain benefits. Clarity and disclosure pricing and financial support would also be needed to standardise such projects under these mechanisms. Article 6 and the adoption of its rulebook announced at COP26 point to enhancing global cooperation and collaboration to mitigate the climate change impacts and keep the 1.5-degree goal alive. Developments under Article 6 of the Paris Agreement paved the way for the use of contemporary market-based mechanisms as an effective mitigation tool for reducing emissions.

Japan has been a global leader in low-carbon emissions technology across sectors. The government of Japan has established the JCM as a bilateral agreement operating under Article 6.2 cooperative approaches of the Paris Agreement (PA), which lays out the framework for international cooperation for the implementation and achievement of NDCs through the use of internationally transferred mitigation outcomes (ITMOs) between countries (Kizzier, et al., 2019). Despite the political proximity enjoyed by Japan and India, the agreement on establishing the JCM between the two countries has not yet been made. However, both countries have ambitious emission reduction targets which accelerate the potential for bilateral cooperation through JCM. As discussed in the previous sections, there is significant potential for both to collaborate in the energy production and demand management arena. While there is a growing need for technology in the key emitting sectors in India, the demand is more pronounced in domestic manufacturing (as promoted through 'Make in India' and 'Zero-effect, Zero-defect' programmes), where India can benefit from technological cooperation with Japan. While the JCM can be beneficial for India, a possible engagement by Japan in the domestic manufacturing market can potentially provide a long-term opportunity for collaboration. Learnings from market-based mechanisms under the Kyoto Protocol such as those of the clean development mechanism (CDM), joint implementation and emissions trading, led to the development of modern voluntary carbon markets under Article 6 of the Paris agreement. Widely agreed by many countries as an effective mitigation tool, these mechanisms allow for the mobilization of finance, especially from the private sector, for cost-effective and ambitious climate mitigation action.

Joint Crediting Mechanism: Potential for Strengthening India- Japan technology collaboration

Japan's Joint Crediting Mechanism (JCM) facilitates the diffusion of advanced low-carbon and zero-emission technologies, products, systems, services and infrastructure and contributes to sustainable development. It is a bilateral cooperative mechanism involving market-based principles that facilitates the diffusion of low-to-zero carbon technologies which contributes to the pursuit of NDCs in developing countries (JCM, 2022). The first bilateral agreement under JCM was signed with Mongolia in 2013 to support the latter's low carbon development initiatives. Currently, 17 countries[1] from Asia and Africa are partnering with Japan on JCM (JCM, 2022).

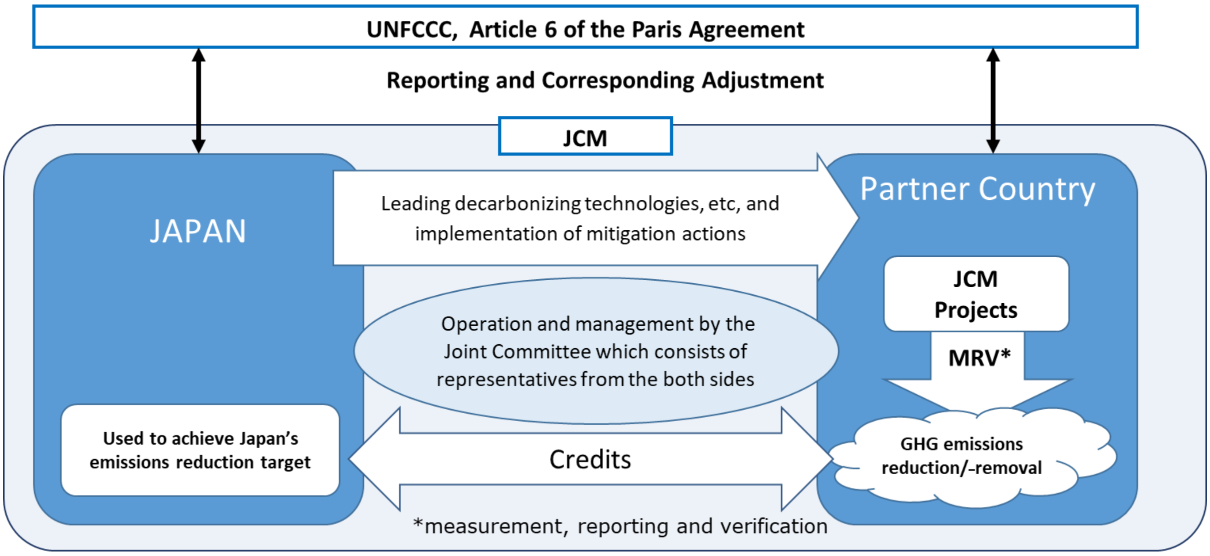
Under the JCM model, removal or reduction of GHG emissions from projects is quantitatively addressed by applying measurement, reporting and verification (MRV) methodologies (ADB, 2016). The programme is designed to take into consideration a robust MRV system, transparency and environmental integrity of its procedures, rules and guidelines while maintaining simplicity and practicality. Through the JCM, low carbon technologies are disseminated in areas of energy efficiency, renewable energy, waste handling and disposal, transport, REDD+, F-gas recovery and destruction. The GHG emissions reductions or removals from the projects are issued as the JCM credits and used to achieve NDCs on both sides: Japan and the partner countries. As of March 2022, the JCM credits are defined as non-tradable credits. Figure 1 shows how the JCM works under Article 6.2 of the Paris Agreement and delivers the GHG emission reductions to achieve both countries' NDCs.

The governance structure of the JCM is made up of a joint committee (JC), including representatives of ministries and agencies of both Japan and the partner countries. The JC is empowered to make all necessary decisions related to adopting JCM rules, guidelines and project registration responsibilities. This would ensure that both countries have an equal partnership, responsibility and accountability in terms of implementing JCM. For supporting the JC and facilitating project development, a JCM Secretariat is established in both participating countries (JCM, 2022). JCM registry systems are developed and maintained by both Japan and the partner countries. JCM procedures also address double counting of emission reductions by establishing JCM registries, which track relevant information for the issued JCM credits. To avoid double-counting, both countries while implementing the JCM have to apply

[1] JCM partner countries: Mongolia, Bangladesh, Ethiopia, Kenya, Maldives, Viet Nam, Lao PDR, Indonesia, Costa Rica, Palau, Cambodia, Mexico, Saudi Arabia, Chile, Myanmar, Thailand, Philippines

corresponding adjustments for internationally transferring and acquiring the credits in accordance with the Article 6 guidance adopted in COP26 (UNFCCC, 2021). The registries also prevent registered JCM projects from being used under any other international climate mitigation mechanisms.

Figure 1. Joint Crediting Mechanism (JCM, 2022)



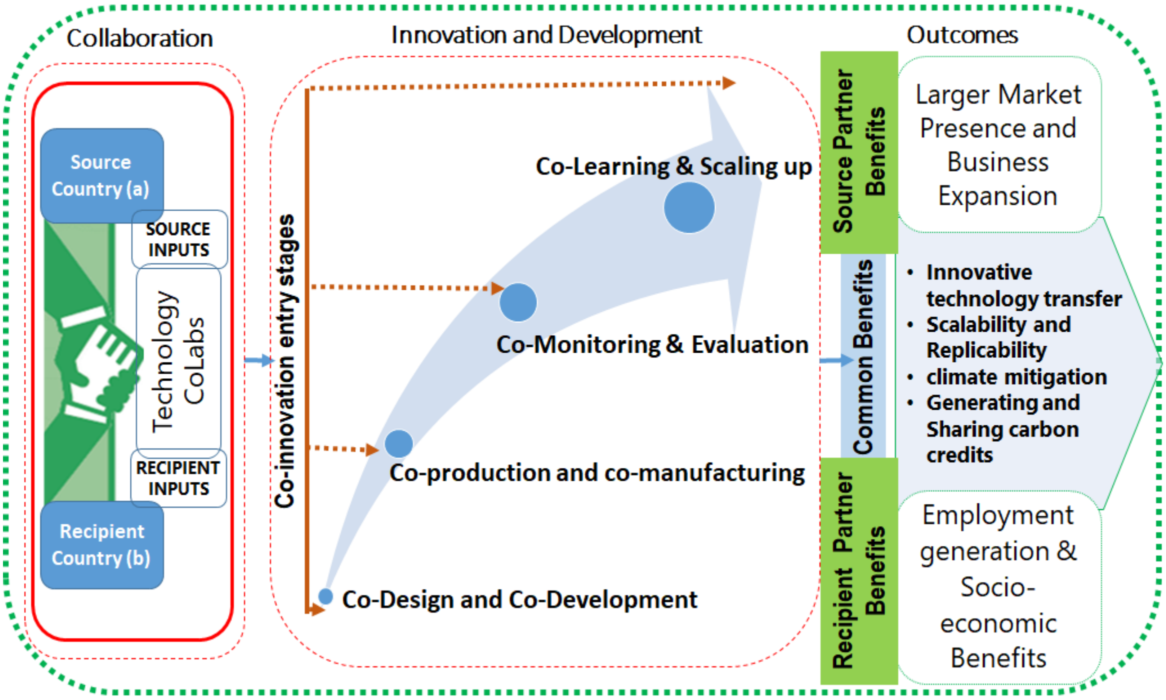
To develop projects through the JCM, private entities from both the partner country and Japan would have to establish an international consortium to apply for JCM financial support. For facilitating low-carbon technologies through the JCM, the government of Japan covers a part of the initial investment cost of transferring technologies. In 2021, the government of Japan announced to increase the financial budget from the public-private partnership up to 1 trillion JPY by 2030 (cumulative), which includes JCM financial support (Ministry of Environment, 2021). In addition, as for supporting sustainable development in the partner countries, technical capacity building for implementing the JCM projects has been conducted. The partner from a Japanese company would support vocational skills for local employees through on-site and/or online training to operate and maintain transferred technologies (Murun & Tsukui, 2020).

JCM deploys global best practices when developing projects with partner countries, the benefits of which go beyond emissions reduction, creating positive economic and environmental impacts (IGES, 2019). The collaboration under JCM has the potential to support India's low-carbon development plans and to fast-track efforts in transitioning its industries towards a more low-carbon emissions pathway.

Japan-India Collaboration in Manufacturing Sector: Examining Opportunities of co-innovation

One of the potential areas of technology collaboration between Japan and India is joint manufacturing and scaling up of clean technologies. While the JCM currently focuses on the transfer of advanced technology-based equipment or machinery to partner countries, Indian stakeholders are likely to find more interest if the two countries can jointly develop, manufacture or scale up these technologies as the Indian stakeholders are interested in being part of the technology development rather than being mere consumers of imported equipment and machinery. The Indian government also has increased the import duty of automobile parts as well as renewable energy equipment into the country (PIB, 2021), to boost domestic production. In favour of domestic manufacturing, the government has been pursuing the *Make-in-India* programme, which gives tax breaks for companies investing in India. The Indian stakeholders perceive that, the sale of finished technology may continue to make the key sectors depend on overseas supply chains which are vulnerable to external geopolitical or economic volatilities. The COVID-19 pandemic exacerbated this concern as the supply of solar renewable energy equipment to India was disrupted affecting the domestic target of achieving 175GW of installed capacity by 2022.

Figure 2. The mechanism for Co-innovation (Janardhanan, et al., 2020)



Collaborative innovation, or co-innovation, involves fostering partnerships between parties for designing and developing innovative value chains that bring together their core competencies with those of others. This open form of innovative collaboration eases limitations and restrictions and brings together a wider range of stakeholders from various institutional bodies. Given the urgent need for technological and social solutions to address the climate emergency, a shift to co-innovating solutions would result in delivering more sustainable outcomes. Co-innovation brings together both parties to collaboratively construct and share responsibility for designing and developing technological solutions, thus creating value for both. Trust, transparency and willingness are the three key elements that underlie collaboration, driving actors to converge and move together toward successive stages of innovation and development. Co-innovation driven by international cooperation among developing and/or developed nations may be a key step for developing high-end solutions incorporating ideas that benefit both people and the planet.

India and Japan's long-standing economic partnership and synergy in industrial relationships offer an opportunity to accelerate the adoption of a co-innovative mechanism in multiple sectors. Japan is widely considered a global leader in the development and deployment of low-carbon technologies (LCT). India's rapidly growing economy with its increasing energy requirements provides a significant potential market for Japanese LCTs, especially in the industrial sectors. The Indian market largely remains untapped for Japanese LCTs as stakeholders in both countries lack the required information, knowledge and expertise to scale down costs and ensure sustainable transfer and large-scale diffusion of LCTs (Janardhanan, et al., 2021). Collaboration through co-innovation could bridge this gap and offer a holistic approach for joint innovation, manufacturing and scaling up of LCTs by source and host countries for accelerating progress on sustainability. Potential areas of collaboration would be the development and scaling up of green hydrogen energy, the use of LCTs in industrial sectors like small and medium enterprises and transitioning the transport infrastructure of the country to entirely running on electricity.

Figure 2 below shows the key steps that involve co-innovation. The first stage focuses on establishing a partnership between the source and recipient countries. This phase also provides an opportunity for the partners to agree on legal matters that are necessary to carry forward the required collaborative work. The next phase involves multiple steps including collaboration on conceptualising, design, production and marketing of the product based on advanced technology. This phase also gives opportunities for co-learning and fine-tuning the product based on the market interest.

The last phase demonstrates what benefits are included in the process of co-innovation. While there are common benefits for both the players which include co-developing a product based on advanced technology which is based on a market interest of stakeholders in multiple geographies, co-innovation also offers specific benefits to both source and recipient partners. While the recipient partners will mainly benefit in terms of opportunities for employment generation and economic advantages from the use of the advanced technology, the source partner gets larger market access to its products based on advanced technology.

Co-innovation deserves greater importance in the context of JCM in Japan-India collaboration. There are three main reasons why India would be keen to have a co-innovation model rather than the originally proposed JCM model of collaboration. First, the sheer size of the Indian industry demands a continuous supply of equipment and machinery based on advanced technology. While the current model of technology collaboration proposed under JCM is based on the subsidised sale of equipment or machinery ensuring the seamless supply would be a challenge for the supplier without having production and manufacturing facilities located within India. Second, the Indian market is traditionally cost-sensitive (Spears, 2014). This has made the Indian technology consumers depend heavily on the Chinese industry manufacturing-based supply chains. For example, until 2020, about 85% of India's solar panel and related equipment supplies were sourced from China or other southeast Asian markets, which mainly Chinese products (Chandrasekaran, 2020). The proposed model of equipment sale to India under the JCM may not help reach any significant scale unless there is a plan for local manufacturing and production. Third, the Indian government has been attributing great importance to the *Make-In-India*[2] initiative to support collaboration with external players. This is also based on the perception that *Make-In-India* would help generate employment thereby accelerating socio-economic co-benefits. As joint manufacturing also receives wider acceptance from national and state governments in India, co-innovation will continue as the preferred approach to give impetus to JCM.

[2] 'Make in India' campaign by the Government of India is aimed at facilitating investment, foster innovation, enhance skill development, protect intellectual property & build best in class manufacturing infrastructure.

Several big technology players have already embarked on joint manufacturing in India. Japanese transportation sector companies such as Suzuki, Toyota and Honda have made remarkable inroads in joint manufacturing with Indian partners. Today the passenger car segment spearheaded by Suzuki Automobile under the name Maruti Suzuki has over 50% of the market share in India and is a well-recognised brand in India. Considering the fact that the Indian industrial manufacturing segment is fast evolving, combining the best practices of JCM with co-innovation will amplify the chances for the two countries to possibly conclude an agreement on long-term technology collaboration.

Mechanisms giving impetus to technology collaboration

Partnerships under mechanisms such as JCM would be ideal in such a situation as projects have largely focused on renewable energy, energy efficiency and other sub-sectors such as transport, waste-to-energy, etc. (JCM, 2022). Already existing domestic initiatives such as Perform Achieve Transform (PAT) Scheme[3] -to-, as well as the bilateral business-to-business collaboration - Japan–India Technology Matchmaking Platform (JITMAP), could give impetus to shaping JCM between the two countries.

The PAT Scheme demonstrates how advanced technologies can be integrated into key emitting sectors in the country. India's PAT scheme already forms an ideal backbone for incorporating the diffusion of LCTs and energy-efficient technologies into the various concerned sectors. Promoting the upgrade and scalability of these initiatives will prove to be easier than considering developing new market technologies. The PAT scheme applies the principles of market-based mechanisms to enhance cost-effectiveness through the use of certification issued when there is excess energy saving. These certifications are then traded in the market created by this scheme. The development of a national registry and regulatory frameworks can be built upon such instruments already operational domestically. Many technologies have been identified under JCM's operations in its partner countries that would be ideal for implementation in the Indian market in the form of large-scale technologies/projects (IGES, 2019).

The JITMAP initiative support realising India's technology needs through business-to-business collaboration. JITMAP is a multi-stakeholder platform initiated to promote the engagement and matching of Japanese and Indian stakeholders, public and private, to facilitate mutually beneficial transactions in LCTs, which include energy-efficient technologies (EETs), best operating practices (BOP), and renewable energy technologies (RETs)[4]. JITMAP aims to connect Japanese manufacturers of LCTs with Indian industries that are looking for such technologies, to the benefit of both sides. JITMAP database and functions would be highly beneficial to create awareness and demand for the JCM in India for market activities.

There is great potential for cooperation using the JCM as a vehicle for Japan to contribute to India's financial-related objectives of the PA. Development and maintaining of registries and building the capacity to do so domestically will be critical in monitoring the market activities which will prevail under market mechanisms. Priority must be given

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[3] Perform Achieve and Trade (PAT) scheme is a market-based compliance mechanism to accelerate improvements in energy efficiency in energy intensive industries under the National Mission for Enhanced Energy Efficiency (NMEEE). NMEEE is one of the eight national missions under the National Action Plan on Climate Change (NAPCC) (https://beeindia.gov.in/content/pat-read-more)

[4] Japan–India Technology Matchmaking Platform (JITMAP) (https://jitmap.org/)

to meeting the NDCs and lowering emissions on the road to a carbon-neutral economy, rather than selling credits internationally.

Recommendations and way forward

1. The lack of advanced technology remains a critical challenge to the industry, transport and energy sectors in addressing emission reduction in India. India requires technological solutions and support for achieving its NDC and other global commitments. This would be a key opportunity for Japan to support through mechanisms such as the JCM. Japan would be a key contributor towards advancing and deploying cleaner energy solutions such as through the development of hydrogen projects. Battery storage technology and grid electrification are other areas where collaborations between the two countries would be beneficial. Enhancing energy efficiency would be one of the most critical areas the two countries could partner with.
2. Stronger political and economic relations between Japan and India can pave the way for a strong foundation for advancing technology cooperation under the JCM. Therefore, it is crucial to establish an agreement on the JCM establishment at a high level between the two countries. Policy dialogues will be necessary to finalise the terms of agreements, guidelines and frameworks for setting up a bilateral partnership for establishing the JCM. Such dialogues can ensure sustainable and localized solutions to the challenges of setting up the JCM in India.
3. Information and knowledge gaps regarding the JCM need to be addressed in the Indian market space. There is a need to create awareness on the methodology and procedures for the JCM among stakeholders in India. This will be critical for shaping a potential agreement between the two countries and also for sustaining interest from Indian stakeholders. Outreach activities undertaken by concerned ministries and other authority bodies could be mobilised to disseminate information on the JCM, thereby creating and directing the demand for market activities. For instance, the Japanese government provides several financing programs for facilitating the implementation of JCM projects in partner countries. Creating awareness about such programs and the merits of utilising such support systems for potential project participants would be beneficial to familiarise key stakeholders, including the private sector, and create significant interest and demand. More opportunities need to be created to communicate the potential benefits of the JCM to India. To do so, a more active dialogue will need to be conducted with multiple stakeholders in parallel, especially with industry and policymakers.
4. Co-innovation - joint development of technology and manufacturing- has significant potential in Japan-India technology collaboration. The Indian government is keen to promote Make-in-India, an initiative aimed at strengthening domestic manufacturing and scale-up. Job creation, strengthening the local economy, advancing capacity building opportunities etc are expected as the additional benefits to India. On the other hand, co-innovation will also give remarkable opportunities to Japanese industry players in accessing the Indian consumer market. It is also important to note that, one of the critical challenges to conventional technology transfer has been the lack of availability of local expertise for post-sale support and spare part availability. Developing domestic supply lines by collaborating with local industry partners

will help overcome this challenge. Co-innovation is not an alternative to JCM, rather it is complementary and can amplify the importance Japan-India technology collaboration to Indian stakeholders. Integration of the carbon credit sharing mechanism can make co-innovation fit into the JCM framework.

5. COP26 resulted in the finalisation of the rulebook for Article 6 which will benefit countries like India and Japan which have prior experience with carbon mechanisms like the Clean Development Mechanisms (CDM). The JCM operationalizes under Article 6.2 cooperative approaches of the PA, which contributes to NDC targets in both participating countries. India would benefit from creating a domestic carbon market to streamline and monitor activities carried out under Article 6. India should also focus on creating an emissions trading route keeping in mind the balance between selling its emission credits and fulfilling the nation's NDC requirements. For operationalizing JCM, India would need to develop and maintain a project registry with Japan to avoid the double-counting of JCM projects.

Conclusion

The lack of adequate technological capacity plays a pivotal challenge for India in accelerating toward its climate mitigation targets. Collaboration with overseas partner countries in strengthening the accessibility and affordability of advanced technology remains critical in this context. This paper presented an overall picture of the technology needs in various sectors in India and also highlighted the potential for collaborating with Japan through JCM. Policies for guiding market mechanisms under Article 6 and the JCM both domestically and internationally need to be set up in consultation with all levels of stakeholders for a holistic and inclusive setup of market mechanisms. The potential identified for such a collaboration under JCM would not only be beneficial for both countries and their commitments towards low-carbon transitions and NDCs but would also contribute to global efforts towards fulfilling the Paris Agreement goals and strengthening its efforts toward a net-zero pathway. However, it is also important to note that India has a keen interest in jointly developing and scaling up technologies that not only strengthen long-term collaboration with partner countries but also help improve the capacity of the domestic industrial manufacturing sector. The country is also keen to protect itself from any potential breaks in the supply chain due to factors such as geopolitical and economic vulnerability or a pandemic-like situation in the future. Moreover, the domestic stakeholders tend to prefer collaborations that could also offer social co-benefits to India in terms of enhancing domestic capacities, improving the employment scenario and boosting the local economy. This leads to the perception that a co-innovation model would find attractive to the Indian stakeholders than being mere customers of imported technology.

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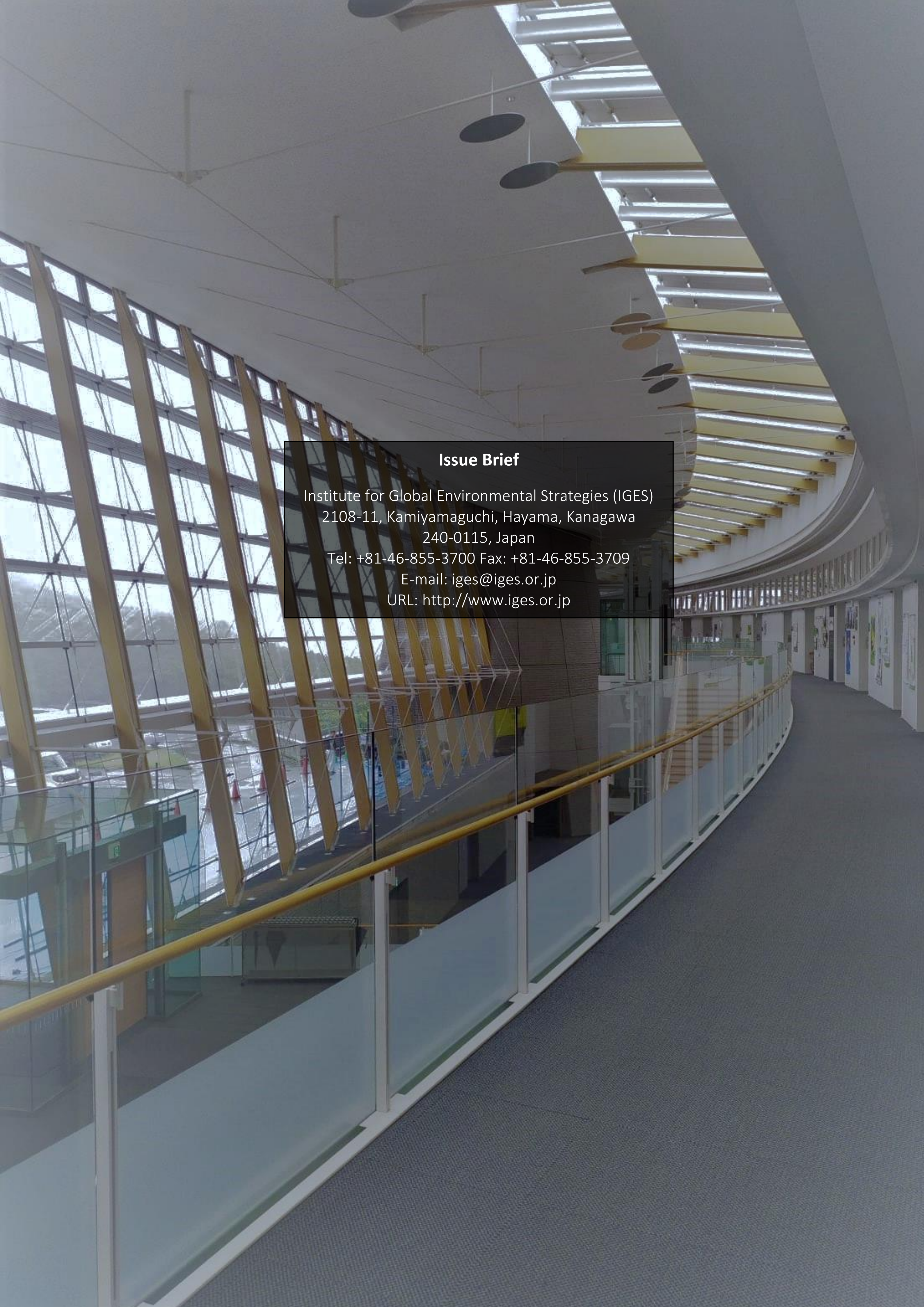

Issue Brief

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